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DOMINION OF CANADA

DEPARTMENT OF THE INTERIOR

Hon. Charles Stewart, Minister W. W. Cory, C.M.G., Deputy Minister

Surveys Bureau: J. D. Craig, Director General

Topographical Survey: F. H. Peters, Director

ANNUAL REPORT

OF THE

TOPOGRAPHICAL SURVEY

FOR THE

FISCAL YEAR ENDED MARCH 31, 1927

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MAPS

56078—1½

REPORT

OF THE

TOPOGRAPHICAL SURVEY, DEPARTMENT OF THE INTERIOR

During the year field activities were continued in all the provinces, except Prince Edward Island, and in Yukon Territory and the Northwest Territories. Twenty-two parties were employed, and in addition four Dominion land surveyors acted as navigational officers for the planes of the Royal Canadian Air Force in taking pictures for aerial surveying operations. Aerial photography has repeatedly demonstrated its value in covering country that could not otherwise be covered without the expenditure of a great deal of time and effort, and also in expediting work carried on largely by the usual methods.

The office work involved in the production and distribution of maps and plans is increasing steadily, in view of the increased amount of mapping now being done. Such mapping is a necessary preliminary and accompaniment to the development of Canada's resources. In new territory, before any natural resource can be properly turned to account, there must be definite knowledge of its location, topography, and potential value. In older territory, the value of this information is evident in many ways.

During the year there were distributed 35,348 maps, 13,132 official plans of townships, townsites, and settlements, and 4,129 other publications. This was a considerable increase over the previous year.

RÉSUMÉ OF OPERATIONS FOR THE YEAR

Topographical and Photo-topographical Surveys.—These surveys are carried on for the purpose of preparing base maps showing natural and cultural detail and for use in agricultural, water-power, mining, and forestry development; in national parks, forestry, municipal, and property administration; in the location of highways and railways; and for other purposes.

New surveys for mapping covered 21,200 square miles as follows:—

	Square Miles
Nova Scotia	280
New Brunswick	120
Quebec	320
Manitoba	2,120
Saskatchewan	15,173
Alberta	2,587
British Columbia	600

In addition a second field revision was made of 6,120 square miles in the province of Manitoba.

Aerial Surveys.—Preparation of the technical instructions for all aerial photographic surveys made by the Dominion Government; direction of the navigation of the aircraft and the operations of the aerial photographers in the unsettled areas of Manitoba, western Ontario, and the Rouyn district in Ontario and Quebec; preparation of mosaics from vertical aerial photographs, and the compiling of topographical maps from both vertical and oblique aerial photographs; indexing, recording, and filing copies of all the aerial photographs of the Dominion Government, and selecting and supplying copies of same to the public, when required.

The aerial photographic surveys during the past fiscal year were for general topographical mapping and map revision, mapping of timber types, forest protection, investigation and development of mineralized and forested areas, irrigation surveys, town planning, road construction, water storage, development of tourist traffic, and for administrative, educational, and illustrative purposes.

The year's work, exclusive of the areas covered by operations conducted for experimental or illustrative purposes only, covered 59,890 square miles distributed as follows: Quebec, 4,825; Ontario, 27,200; Manitoba, 24,275; Saskatchewan, 1,955; Alberta, 1,375; British Columbia, 260.

Control and Exploratory Surveys.—Work under this head included traverses of northern waterways for control of settlement lots and mining claims, and for mapping from oblique aerial photographs for general development purposes; control for plane table topographical surveys; and explorations in the Northwest Territories.

Control traverse surveys were distributed as follows: Ontario, 374 miles; Saskatchewan, 507 miles; Northwest Territories, 150.

Control surveys for topographical mapping were carried on as shown in the following table:—

Province	Traverse		Levels	
	Chain	Stadia	Spirit level	Stadia
	miles	miles	miles	miles
New Brunswick	122	301	136	279
Quebec	137	240	222	190
Manitoba	.....	.....	.....	525
Saskatchewan	.....	.....	.....	1,165
Alberta	.....	.....	300	
British Columbia	.....	.....	.....	300 (approx.)

In Alberta in addition to the 300 miles of spirit levels shown above, some spirit and stadia levels were run for mapping a special area in the vicinity of Calgary.

Explorations in the Northwest Territories extended along 350 miles of hitherto unknown waters.

Land Surveys.—Including the re-establishment of lost corners; township subdivision; and the survey of water areas, town and settlement lots, timber berths, Dominion parks and forest reserves, etc.

One party was engaged on the Kootenay Park boundary in British Columbia; one party was engaged on miscellaneous surveys in the Railway Belt and another on miscellaneous surveys in Manitoba and Saskatchewan; and one party was engaged for a part of the season in northern Alberta on subdivision.

Land Classification Surveys.—These surveys were carried on within certain areas, in order to differentiate between lands suited to agricultural pursuits and those which should be reserved for forestry, park, or grazing purposes.

The arable lands were systematically classified and graded, the classification being based on important factors relative to their soil constituents, the nature of their surface, the surface covering, their accessibility, and other factors related to their ultimate development.

During the period under review these examinations covered 1,514,400 acres, within the provinces of Saskatchewan and Alberta as follows: Saskatchewan, 301,600 acres; Alberta, 1,212,800 acres.

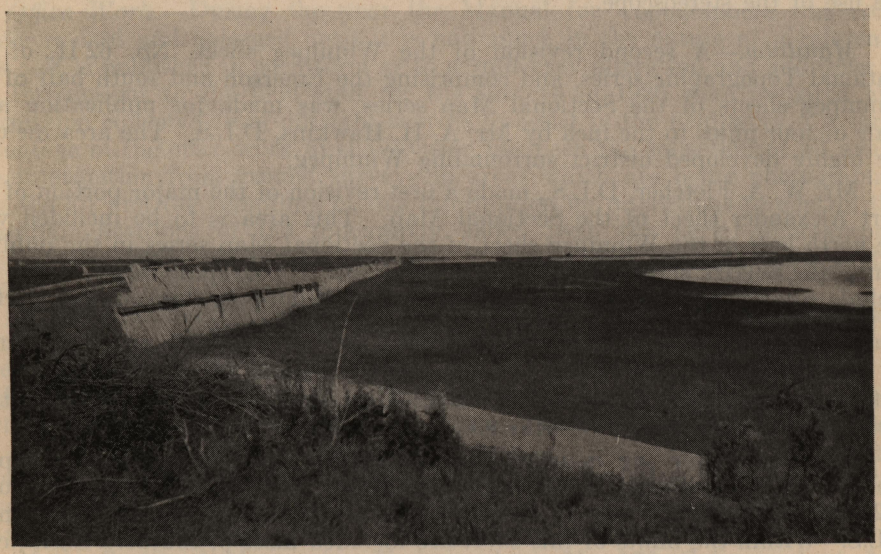
Other Work.—In addition to the above and to the regular work of administration, the other activities are included under the headings of Magnetic Surveys; Physical Testing Laboratory; Mechanical Operations; Registration, Records and Distribution; Geographic Board of Canada; and Board of Examiners for Dominion Land Surveyors.

TOPOGRAPHICAL AND PHOTO-TOPOGRAPHICAL SURVEYS

During the field season of 1926 topographical surveying was carried on in every province of Canada except Prince Edward Island. New mapping comprised 21,200 square miles. In addition a secondary field revision of 6,120 square miles was completed. Information was collected for the publication of the first sheet in Canada of the International Map of the World series. This series is designed to completely cover the surface of the earth with map sheets similar in size, scale, reference, and general composition. Each sheet is designated by a combination of letters and numbers that indicates its position with reference to any other sheet. Experimental work in the use of vertical aerial photographs for mapping on the one inch to one mile scale was continued, mapping on mosaics and on individual photographs with the aid of the stereoscope being considered. To control topographical mapping 658 miles of spirit levels and 2,459 miles of stadia levels were run, in addition to some spirit and stadia levels for mapping a special area in the vicinity of Calgary.

Following is a short description of the field work accomplished:—

Nova Scotia.—Mr. A. L. Cumming, D.L.S., and Mr. G. A. Bennett, D.L.S., mapped 280 square miles by plane-table with a contour interval of twenty-five feet for publication at a scale of one mile to the inch. This survey completed the Wolfville sheet, No. 21 H/1, of the National Topographic series and



DYKES AT GRANDE PRE, NOVA SCOTIA

In this, the land of Evangeline made immortal by Longfellow's famous poem, "dykes that the hands of the farmer had raised with labour incessant" still shut out "the turbulent tides" and today, as in that day, the flood gates are opened at stated seasons. This area is covered by the Wolfville sheet of the National Topographic series, the field work of mapping which was completed during the 1926 field season.

also the Blomidon peninsula to Cape Split. The map shows the development that has taken place around Minas basin and the sheltering escarpment on the northwest. To the southeast the terrain rises into hills cut by deep valleys. The area also includes several excellent power sites along the Gaspereau river, the mapping of which is much appreciated by those interested in hydro-electric development.

New Brunswick.—The control necessary for the mapping of the Fredericton sheet, No. 21 G/15, of the National Topographic series, at a scale of one mile to the inch with a contour interval of twenty-five feet, was laid down and an area of about 120 square miles was plane-tabled by Mr. B. W. Waugh, D.L.S. The sheet includes the city of Fredericton, capital of New Brunswick, the towns of North Devon, South Devon, and Marysville, a cotton manufacturing centre. The St. John river, with its fertile valley, passes across the northern part of the sheet. It is along this stretch of the river that some of the early settlements of the province took place.

Quebec.—The mapping of the Shawinigan sheet, No. 31 I/10, of the National Topographic series, was completed by Mr. C. Rinfret, D.L.S. The sheet is about 400 square miles in area and centres on the St. Maurice river. It is to be published at a scale of one mile to the inch with a contour interval of twenty-five feet. The mapping was done by plane-table on field sheets made up of vertical aerial photographs arranged into mosaic form. About one-half of the area is intensively farmed; power developments at Shawinigan Falls and Grand Mere are attracting important industries.

Ontario.—As a preliminary investigation for power development a small area at Carillon falls, on the Ottawa river, was mapped at a scale of 400 feet to the inch with a contour interval of five feet. Plane-table methods with single vertical aerial photographs were used, the work of contouring was facilitated by the use of the stereoscope.

Manitoba.—A second revision of the Winnipeg sheet, No. 62 H, of the National Topographic series, and comprising the Emerson and south half of the Winnipeg sheets of the Sectional Map series, was made for publication at a scale of four miles to the inch by Mr. A. H. Hawkins, D.L.S. The area includes the highly developed district surrounding Winnipeg.

Mr. W. A. Fletcher, D.L.S., made a first revision of the major portion of the Fort Alexander sheet of the Sectional Map. This area is to be included with the north half of the Winnipeg sheet of the Sectional Map series in the publication of the Selkirk sheet, No. 62 I, of the National Topographic series. This will include a large farming district to the north of Winnipeg, the southern portion of lake Winnipeg and large areas of pulpwood to the east.

Saskatchewan.—Mr. G. C. Cowper, D.L.S., made a first revision of the Battleford sheet, No. 267, of the Sectional Map series. In this revision vertical aerial photographs were used over 800 square miles of the area.

Information for the issue of sheet N.M-13 of the International Map of the World, lying within north latitudes 48° 00′ and 52° 00′ and longitudes 102° 00′ and 108° 00′ west of Greenwich, was collected by Mr. P. E. Palmer, D.L.S. Within the limits of this sheet are included most of southern Saskatchewan and parts of Montana and North Dakota. The publication is to be at a scale of 1:1,000,000 with a contour interval of 100 metres and will be the first sheet of this series, uniform and correlated throughout the world, to be published in Canada. The area in Canada is covered by the revised sheets of the Sectional Map series with the exception of Wood Mountain, Willowbunch and

parts of Nut Mountain and Humboldt sheets. Information for these sheets was collected by Mr. Palmer, and data of the area between north latitudes 48° 00′ and 49° 00′ are being supplied by the United States Geological Survey.

Alberta.—The first revision of the Victoria sheet, No. 365, of the Sectional Map series, was completed by Mr. W. Christie, D.L.S., while classifying the land in this area. Vertical aerial photographs were used.

Mr. M. P. Bridgland, D.L.S., was employed on the mapping of an area in the vicinity of Calgary, lying within north latitudes 50° 45′ and 51° 15′ and longitudes 113° 30′ and 114° 30′ west of Greenwich, and comprising the four sheets Nos. 82 I/13, 82 P/4, 82 J/16, and 82 O/1, of the National Topographic series. The area is to be mapped by plane-table survey for publication at a scale of one mile to the inch with a contour interval of twenty-five feet. Six hundred and seventy-five square miles were completed, including the whole of the Calgary Northeast sheet, No. 82 P/4, two hundred and forty-five square miles of the Calgary Southeast sheet, No. 82 I/13, and twenty-five square miles of the Calgary Southwest sheet, No. 82 J/16.

British Columbia.—The field work of all but a very small area of the Kamloops Lake sheet, No. 92 I/NE., to be published at a scale of two miles to the inch with a one-hundred-foot contour interval, was completed by Mr. C. H. Taggart, D.L.S. Both photo-topographical and plane-table methods with transit and range finder were used. The triangulation necessary in this work tied up the net along the railway belt with that of the British Columbia Government surveys. As in previous years, reference monuments were established on the stadia surveys falling within forest reserves.

Mr. L. E. Harris, D.L.S., under the supervision of Mr. M. P. Bridgland, D.L.S., completed the survey of the area covered by the Revelstoke sheet, No. 82 L/16, of the National Topographic series, by photo-topographical methods. This work is to be incorporated in the publication of sheet No. 82 L/NE. at a scale of two miles to the inch with a contour interval of 100 feet.

Office Work.—During the year the Manual for Topographers was completely revised and enlarged until it is now much in the nature of a reference book. It is published in such form as to permit easy alteration and additions.

Instructions to the field staff for the surveys of 1926 were prepared and information collected from different sources to assist in the field work. A large percentage of the office work of the division has been the collection of all available information from ground surveys in areas which are being photographed from the air and the compiling of this information on projections to control the geographic positions of the topography added from the aerial photographs. This entailed work on sixteen four-mile sheets of the National Topographic series.

Of the National Topographic series at the one mile to the inch scale, the Kamloops sheet, No. 92 I/9, and Lake Louise sheet, No. 82 N/8, have been issued. The Sorel, No. 31 I/3, Sussex, No. 21 H/12, New Glasgow, No. 11 E/10, Wolfville, No. 21 H/1, and Calgary Northeast, No. 82 P/4, sheets have been assembled and are now with the Mechanical Division. The Shawinigan sheet, No. 31 I/10, is being assembled. The Revelstoke, No. 82 L/NE., and Kamloops Lake sheet No. 92 I/NE., on the two miles to the inch scale, and the Winnipeg sheet, No. 62 H, and the Selkirk sheet, No. 62 I, on the four miles to the inch scale, are in the process of being assembled or compiled.

Of the Sectional Map series, Yorkton sheet, No. 170, Calgary sheet, No. 114, Sullivan Lake sheet, No. 216, and Weyburn sheet, No. 20, of the revised edition, have been published and the Touchwood sheet, No. 169, is compiled. Vermilion sheet, No. 316, Dunvegan sheet, No. 462, Battleford sheet, No. 267, Victoria sheet, No. 365, and Athabaska sheet, No. 213, are being compiled.

Sheet N.M.-13 of the International Map of the World series is being compiled. Of the National Parks of Canada and National Forest series, Buffalo Park and Cypress Hills Forest Reserve maps have been published; Yoho Park map is compiled and in the hands of the Mechanical Division, and Kootenay Park and Waterton Lakes Park maps are being compiled. The map of the Central Experimental Farm and Vicinity, Ottawa, and the St. Johns and Iberville contoured mosaic have been issued.

AERIAL SURVEYS

During the fiscal year 1926-27 practically all the oblique aerial photographic surveys undertaken were carried out by flying boats operating from the Winnipeg air base or sub-bases in that district. From these surveys seven

AIRCRAFT AT CORMORANT LAKE SUB-BASE

An Avro seaplane, single float type, used chiefly for the detection of forest fires, is depicted in the foreground. The other seaplane, a "Viking" amphibian flying boat, is capable of carrying a maximum permissible load of 5,800 pounds. This larger type of machine, in addition to being of great value for forest patrol and fire suppression work, has been used extensively for taking aerial photographs for mapping purposes. Cormorant lake is on the Hudson Bay railway in Manitoba.

map sheets of the National Topographic series on the four-mile scale have been compiled.

Each of these map sheets covers an area of approximately 94 miles in length by 70 miles in width, extending two degrees in longitude and one degree in latitude. The areas covered by The Pas, Grand Rapids, Cormorant Lake, and Wekusko Lake sheets were photographed in the fall of the year when the change in the colour of the leaves of the deciduous trees, a record of which was obtained in the photographs, served to assist in classifying the timber stands

by differentiating between the coniferous and deciduous types, and made the photographs of great value to the Forest Service, Department of the Interior, in the administration of the pulpwood areas. Preliminary maps of The Pas and Grand Rapids sheets have been prepared by hand for the forest service. In addition to water and cultural features, the limits of merchantable stands of timber have been indicated together with those of burnt-over areas, muskegs, etc., which latter information by the process of elimination, will greatly assist the forester in his ground surveys.

The area covered by Trout Lake, Sioux Lookout, and Armstrong sheets, north and west of lake Nipigon and northeast of the Red Lake district in Ontario, is attracting a great deal of attention owing to its promising mineral possibilities and these maps will greatly assist in the development of this region.

Owing to the urgent requests for preliminary maps of parts of these unknown areas, for immediate use in winter road construction and general development purposes, a preliminary plotting of the uncontrolled oblique photographs concerned was resorted to in several cases in order to supply quickly the desired information, and the results furnished were exceedingly helpful and greatly appreciated.

The most extensive operation of the vertical aerial photographic surveys was carried out from the Ottawa air base. It covered areas in Ontario and Quebec aggregating about 6,000 square miles, of which about 5,650 square miles was in the vicinity of the Rouyn mining district. In plotting these photographs the intersection or radial method was used based on the assumption that directions as measured on the photograph are true where these directions are measured at the principal point. The method assumes that the flying has been carefully done and the elevation of the plane evenly maintained; the plotting carried out to the average scale of the photographs; and that the range of relief in the area photographed is small when compared with the flying height.

Photographs were taken in the Rouyn area in strips from an altitude of about 10,000 feet above the ground using cameras and lenses of about 8-inch focal length.

Vertical aerial photographic surveys covering over 3,000 square miles were also carried out in Alberta from the High River air base. The utilization of vertical aerial photographs in these areas for mapping purposes is very often greatly facilitated by the absence of marked relief and by the presence of monuments and other evidence marking the original section or cadastral surveys whereby the area was, preliminary to settlement, subdivided into mile and half-mile squares. The fences subsequently built by the quarter-section owners around their holdings and the travelled roads adjoining these lines, when visible in the photographs, furnish checkerboard control with which the distorting effects of tilt and the slight relief of the land surface so far as they affect the reduced scale of the issued map, become of negligible magnitude.

During the past fiscal year detailed instructions to accompany twenty-nine operation orders were written and guide maps were prepared to show the projected lines of flight. Where the existing maps were unreliable or where none were available, a Dominion land surveyor, skilled in exploration and mapping from both ground and aerial surveys, accompanied the crew of the aircraft as navigators. Messrs. J. Carroll, D.L.S., R. D. Davidson, D.L.S., C. B. C. Donnelly, D.L.S., and E. S. Fry, D.L.S., were employed on this work.

Aerial surveys during the fiscal year as already stated on page 6 covered an area of 59,890 square miles. Of this, 50,290 square miles were by oblique and the remainder, 9,600 square miles, by vertical photographic surveys. This is a total increase of 10,723 square miles over the previous season.

56078—2½

From the surveys performed during the season, the following sheets of the National Topographic series have been compiled:—

Rouyn-Larder Lake and Rouyn Lake sheets on the two-mile scale, from vertical aerial surveys.

The Pas, Grand Rapids, Cormorant Lake, Wekusko Lake, Trout Lake, Sioux Lookout, and Armstrong sheets, on the four-mile scale, from oblique aerial surveys.

Vertical aerial photographic surveys covering portions of three other sheets on the two-mile scale in the Rouyn district and oblique aerial photographic surveys covering Lake St. Joseph sheet and portions of five other sheets on the four-mile scale north and west of lake Winnipeg have been made but the preparation of these map sheets is withheld until further control and aerial surveys have been carried out in these areas.

AERIAL CAMERA AND MOUNT

This new mount allows the camera axis to be depressed below the horizontal, the camera body to be rotated about its own axis, or the entire camera to be swung along a circular track so that photographs may be taken to the right or left as well as along the line of flight.

Prints of all aerial photographs taken by the Royal Canadian Air Force are recorded, indexed, and filed in the Aerial Surveys Division of the Topographical Survey where they are available for the inspection of the public. Although aerial photographs are often taken at the request of one particular service it is known that they will be of great value to several other services, especially in connection with future developments in the areas covered, and the aim is to make the information they contain accessible to all.

So far, over one hundred thousand aerial photographs have been received to be recorded, indexed, and filed, and this year it was thought advisable to adopt a new indexing system which would fulfil all future requirements.

During the year a total of 80,522 photographs were received. Of these 42,634 were for the index and the remainder were for constructing mosaics and supplying surveyors in the field, officials of the provincial governments, city engineers, mining and lumbering corporations, and municipalities.

CONTROL AND EXPLORATORY SURVEYS

Control surveys were extended during the year in accordance with the program outlined in previous reports, namely, of building up a strong network of control surveys, establishing monuments in known geographical positions, and providing adequate ground control for mapping from aerial photographs.

The great prospecting and mining activity in northwestern Ontario and the interest now being evinced in the country north of lake Nipigon, in connection with proposed schemes of water diversion and power development, created an urgent demand for topographic maps of these areas, the existing maps being either very sketchy and unreliable or in many places completely blank. Co-operation which has proved advantageous to both parties has been brought about between this organization and the Ontario survey authorities by which aerial photographs were supplied in advance to Ontario land surveyors and returned to this office at the end of the season with the positions of the surveyors' stations marked thereon. The photographs themselves are of great value to a surveyor planning to operate in unexplored territory, and when they are returned to this office with the positions of survey stations marked, these can be used as control for mapping the photographs.

In addition to continuous traverse surveys and co-operation with surveyors of the Surveys Branch, Department of Lands and Forests of Ontario, and the surveyors of the Ontario Hydro-Electric Power Commission, astronomical observations for latitude and longitude were taken at selected points so as to free the continuous traverse surveys from the effects of cumulative errors and provide control in localities where traverse surveys could not be economically run.

In northern Saskatchewan, in connection with the possible future development of mineral and forest resources, the need for topographic maps has been keenly felt. The necessary ground control was run for mapping the area in the vicinity of Churchill river and monuments were established, which are directly connected with and become a part of the Dominion Lands system of survey.

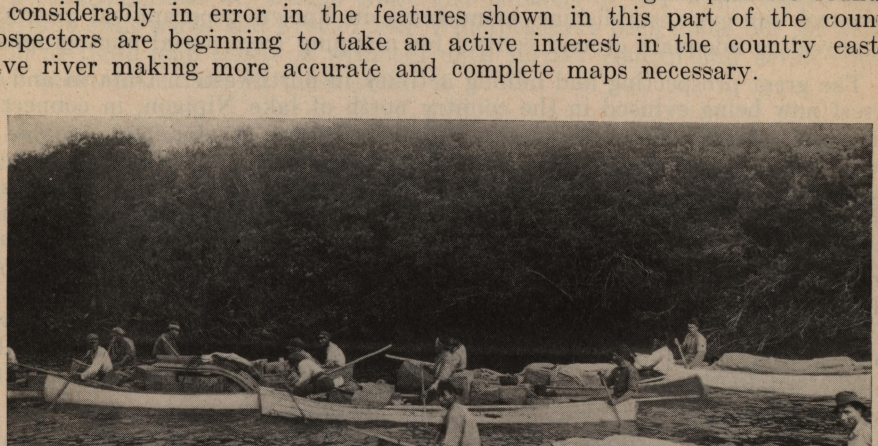
Control Surveys of Ontario.—Mr. J. W. Pierce, D.L.S., carried a continuous traverse survey from Trout-lake river via Woman lake, Birch lake, and Cat river to lake St. Joseph, also from the eastern end of lake St. Joseph via Wabakimi and Savant lakes to the Canadian National Railways station at Bucke.

Messrs. S. D. Fawcett, D.L.S., M. G. Cameron, D.L.S., and K. F. McCusker, D.L.S., spent part of the season in interpreting aerial photographs in special areas and providing control by astronomical observations and small local surveys.

Control Surveys in Saskatchewan.—Mr. C. S. Macdonald, D.L.S., carried continuous traverse surveys from a post of the Dominion Lands system on Montreal lake down Montreal river through Lac la Ronge and Nemeiben lake to Churchill river, which river was also traversed from Sand Fly lake to Frog Portage. A traverse was also carried from Lac la Ronge across the portage to Wabawekka lake east to Deschambault river and Oskikebuk lake.

Surveys and Explorations in Northern Alberta and in the Northwest Territories.—In the Northwest Territories, Mr. G. H. Blanchet, D.L.S., carried on investigations in the Wood Buffalo park and surveyed some of the rivers of that region. The increasing numbers of buffalo make it necessary that the topography and feed situation in the park be studied to assist development and administration. The work of this year was preliminary to an aerial survey to be made in the near future.

The investigation of the country between lake Athabaska and Great Slave lake was continued by an exploration across the Arctic-Hudson Bay divide by the headwaters of Tazin and Dubawnt rivers. Existing maps were found to be considerably in error in the features shown in this part of the country. Prospectors are beginning to take an active interest in the country east of Slave river making more accurate and complete maps necessary.



SUPPLIES FOR AERIAL PHOTOGRAPHIC OPERATIONS

Gasoline and other supplies en route for Stanley and Lac la Ronge in northern Saskatchewan to be used later by seaplanes engaged in aerial photographic mapping.

Control Surveys in Quebec and New Brunswick.—Control surveys were made over the Grondines area in Quebec, latitude 46° 30′ to 46° 45′ and longitude 72° 00′ to 72° 30′, by Mr. P. M. H. LeBlanc, D.L.S.; and over the Fredericton area in New Brunswick, latitude 45° 45′ to 46° 00′ and longitude 66° 30′ to 67° 00′, by Mr. B. W. Waugh, D.L.S. These surveys were required as a base for topographical mapping on the scale of one mile to one inch.

For such areas the control required must be of a high order of accuracy. Wherever the triangulation of the Geodetic Survey of Canada has been extended over or near areas that are required to be mapped, the topographic control for mapping is tied in to geodetic triangulation stations, and an accurate system of control established according to the North American Datum. The control surveys of the above two areas consist of transit and chained traverses between triangulation stations, stadia traverses for short distances between points on the chained traverses, and spirit and stadia levels. As the surveys progressed, permanent monuments were established at chosen points within the areas to be mapped, and tied in to the chained control. The geographical co-ordinates of these monuments are computed, and in this way these monuments provide

permanent marks which serve as starting points and control for Dominion, provincial, municipal or other surveys. The order of accuracy required for the chained traverses in the two areas above was placed at one in five thousand. Actually, however, the surveys as made on the ground in each case have been found to considerably exceed this order of accuracy.

In the Grondines area in Quebec the control consists of 137 miles of transit and chain traverse, and 240 miles of stadia. Seventeen monuments were established.

In the Fredericton area in New Brunswick, 122 miles of transit and chain traverse were made, 136 miles of spirit levels, 301 miles of stadia traverse, and 279 miles of stadia levels. The twenty-four monuments established in the Fredericton area were pre-cast concrete monuments forty inches long, eight inches square at the base and five inches square at the top, with a standard post centered within the concrete. When planted, about four inches appears above the surface of the ground.

LAND SURVEYS

Although the volume of subdivision surveys has decreased within recent years there has been a marked increase in the volume of inquiries relating to the lands surveyed in the past.

Correspondence relating to land surveys, apart from that with surveyors employed on field work is largely with other branches of the Department of the Interior, with the addition of a considerable amount from other departments, provincial and municipal officials, and the general public. The nature of the business dealt with ranges from the answering of routine enquiries respecting areas of lands, measurements, etc., to questions which require quite extensive research and very careful consideration, as for example, cases of disputed boundaries. In all about 1,200 communications were dealt with, about 200 sketches and plans prepared, and the areas of about 2,800 parcels of land furnished.

An increase in the number of communications dealt with of about fifty per cent over the previous year is mainly due to the large number received from the Dominion Lands Branch in connection with the disposal of areas left dry by the recession of water in lands previously granted as railway subsidies.

Much work was entailed in the preparation of a schedule of areas surveyed and unsurveyed in forest reserves within the Fertile Belt for the use of the Land Patents Branch in making a final adjustment of the claims of the Hudson's Bay Company.

As in previous years, a large number of areas were furnished to municipal officials for assessment purposes.

Plans showing old surveys of about forty townships were prepared for the use of provincial officials in Manitoba.

Surveys in British Columbia.—Suburban lot subdivision of lands near the Coast, released from timber berths upon the completion of logging operations, comprised over a third of the work done in the Railway Belt of British Columbia during the year. Surveys of Indian reserves for the Department of Indian Affairs occupied an equal period while the remainder of the season was taken up with the survey of two timber berths, three irregular parcels of land for summer homes, and a lot subdivision for a summer resort. These were performed by Mr. J. A. Calder, D.L.S.

The suburban lot subdivisions were made in township 2, W.C.M., and townships 13 and 16, E.C.M., adjacent to provincial highways over which there was a heavy motor traffic. These surveys were rather intricate since the last

official surveys in the vicinity were, for the most part, nearly fifty years old and provision had to be made for the exclusion of the right of way for the Great Northern Railway and the provincial highways. The old surveys were found to be nearly obliterated and original monuments hard to find, although old bearing trees were found at the most important governing corners.

These subdivisions were made near good markets with easy transportation, allowing intensive cultivation; the lots adjoining the highways were laid out with an area of ten acres or less while the rear lots were given about twice that area.

The local municipal authorities were consulted with regard to the location of the permanent road allowances and provision was made in the survey to allow of the use of the old logging railway grades until the improvement of the regular road alowances can be effected.

The Indian Reserve surveys consisted of surveys of new reserves near Lytton and the retracement of the boundaries of old reserves in the Nicola valley with the necessary ties to the Dominion lands system of survey. The original surveys of these old reserves had been made by the Department of Indian Affairs many years ago and their retracement was necessary in order that the adjoining Dominion lands might be dealt with. New reserves surveyed were allowed by the Indian Commission which sat in 1916 and in most cases formed additions to old reserves. Standard survey posts were used on this work and generally the standard of the work was equal to township subdivision surveys.

The timber berth surveys were in township 4-2-7, between Stave and Davis lakes in rough mountainous country with a dense growth of small timber suitable for telegraph poles. Certain legal subdivisions adjoining Davis lake were surveyed for settlement.

Two of the irregular parcels for summer homes were on Harrison lake not far from the famous hot springs, while the third was on Pitt lake. Suitable sites for this purpose are rather scarce on such lakes as these, surrounded as they are by high precipitous mountains. Accordingly, available locations are being rapidly taken up. Effecting the necessary ties to existing surveys was the most difficult feature of this work.

The Bastion Bay Summer Resort survey consisted of a tier of lots along the shore of Shuswap lake within easy reach of Sicamous. The land subdivided proved valueless for agriculture and the freedom from mosquitoes made the area desirable as a site for summer homes to the residents of this divisional point on the Canadian Pacific railway. Provision was made for the extension of the subdivision should future developments warrant.

In addition, Mr. R. W. Cautley, D.L.S., B.C.L.S., was engaged in defining the boundaries of Kootenay National park in accordance with an agreement previously entered into by the Government of British Columbia and the National Parks of Canada Service.

Instructions for this work were prepared in this office and approved by the two contracting parties.

A small lot survey was also performed by Mr. C. H. Taggart, D.L.S., at Sicamous Junction.

In the Railway Belt of British Columbia the survey of the available surface rights of a number of mineral claims was performed by private surveyors, commissioned both as Dominion Land Surveyors and British Columbia Land Surveyors, under instructions from this office. The survey returns were examined in this office and descriptions prepared for the transfer of the available surface rights to the province.

Surveys in other provinces.—In Saskatchewan, a subdivision was made of a portion of a school land section adjoining Rosetown upon which a number of substantial residences had been erected by squatters.

In Manitoba, surveys were made at the request of the Ordnance, Admiralty and Railway Lands Branch at Badger, Rackham, and Mafeking. The survey at Badger was for the purpose of laying out additional lots for disposal; twenty lots were added to the twenty-eight lots already surveyed. At Rackham, some alterations were necessary owing to additional station grounds being required by the railway which overlapped certain lots already laid out, and owing also to certain other corrections to the previous survey rendered necessary by the discovery of an error in the plan of railway right of way from which the new right of way was granted. At Mafeking, a small cemetery was laid out and a school site, several industrial sites, and a few additional town lots were surveyed.

At Duck Bay on lake Winnipegosis, settlement lots were laid out to meet the requirements of a number of half-breed squatters, where ordinary township subdivision would not give a satisfactory allotment of the land occupied. In addition miscellaneous surveys were conducted in a number of townships.

These surveys in Saskatchewan and Manitoba, enumerated above, were performed by Mr. R. H. Knight, D.L.S.

In Alberta, about thirty square miles of Saddle Lake Indian reserve were subdivided by Mr. Wm. Christie, D.L.S., part for the Soldier Settlement Board and the remainder for the Department of Indian Affairs.

Surveys of quartz mining claims in the Rice Lake, Wekusko Lake, and The Pas mining districts in Manitoba and at Keno Hill in the Yukon Territory were continued. These were performed by private surveyors commissioned as Dominion land surveyors, but the Quartz Mining Claim regulations provide that such surveys shall be made under instructions from and the survey returns be examined and approved by this office. Instructions were prepared in detail for the survey of 101 claims and the returns of survey of 177 claims, about half of which were in triplicate, were examined for approval.

In addition, Mr. H. G. Dickson, D.L.S., surveyed under contract from this office, some twenty-eight miles of reference traverse in the Yukon Territory.

Two hundred and sixty-four plans of road surveys were submitted by the western provinces to the Surveyor General for examination and acceptance as required by statute in order to acquire title to the rights of way.

Plans of surveys of railway rights of way are examined for approval by the Surveyor General prior to being used by the department. Twenty-six such plans comprising forty-seven tracings were dealt with during the year.

Fourteen irrigation plans and seventeen miscellaneous plans were examined to determine whether they were sufficient for departmental purposes.

In addition to the foregoing, fifty-six township plans and twenty-six miscellaneous plans were prepared for the draughtsmen, and one hundred and twenty-seven plans were compared with the compiled plans before approval.

In connection with the foregoing work 7,240 recorded field books and plans were consulted.

LAND CLASSIFICATION SURVEYS

To assist in directing settlement and to provide prospective settlers with information of interest relating to promising areas of land suitable for settlement, and also to assist in the selection of those lands which are best adapted for either grazing or forestry, land classification surveys have been carried on during the past few years. To date the areas so covered and examined total 30,820,440 acres, including nearly 4,000,000 acres within forest reserves.

During the past season two field parties were engaged on land classification surveys operating respectively in the provinces of Alberta and Saskatchewan, examining a total of 1,514,400 acres of land of which 273,280 acres are located within forest reserves.

In the province of Alberta Mr. Wm. Christie, D.L.S., by a combined land classification and revision survey, covered an area of 1,212,800 acres included within the north half of the Victoria sheet of the Sectional Map series, comprising townships 61 to 64, from range 15 westerly to the Fifth meridian. The south half of this sheet had been covered during the previous season.

In the province of Saskatchewan, Mr. G. J. Lonergan, D.L.S., was engaged on classification surveys within and adjoining the Big River, Pines, and Nisbet forest reserves, in order to ascertain whether agricultural lands were included within the reserves, or if lands of no agricultural value were adjacent to them. The advisability of withdrawing the lands from the forest reserves in the one case or of adding them to the reserves in the latter was reported upon to the Forest Service.

In the Seward forest reserve the examination covered all the lands within its different blocks, together with additional lands adjacent to certain of these blocks; in the Fort à la Corne forest reserve the examination was partly within and partly outside of its present boundaries; and in the Three Rivers forest reserve the area examined lay totally outside of and adjacent to its western boundary.

The total area thus examined is 301,600 acres, comprising 273,280 acres within and 28,320 acres outside of forest reserves.

Office work during the year included the regular work of checking, compiling, and co-ordinating the results of the field investigations, prior to their release either for the use of other departmental services or the general public. Among the items distributed were twenty-two bound typewritten reports and twenty-one portfolios of plans relative to investigated districts. These were supplied to Dominion Land agencies, sub-agencies, provincial officials, and colonization and development departments of the Canadian National and Canadian Pacific Railway companies.

MAGNETIC SURVEYS

It is well known that the compass does not point north but more or less to the east or west at different places. In order that the compass may be used with reliance, the different countries of the world measure the true compass direction or "declination" as it is called, and show it on declination charts.

For the purpose of supplying this information for our own country, precise declination surveys, in close co-operation with the provinces, were conducted by all the survey parties during 1926. As in the past, this work entailed practically no expense, being carried on in conjunction with the regular surveys and making use of astronomical bearings available from them. Some 800 precise declination observations were thus obtained throughout the country from the Atlantic to the Pacific and from the International Boundary almost to the Arctic Circle. The total number of observations obtained throughout the country since this work was started in 1880 is now over 22,000.

Many observations were obtained in new country along the Churchill river, Saskatchewan; in the area between lakes Nipigon, Seul, and St. Joseph, Ontario; Kootenay Park, British Columbia; Wood Buffalo Park, Alberta and Northwest Territories; the area between Black bay of lake Athabaska and Wholdaia lake; western Nova Scotia; the St. John valley, New Brunswick; and in Quebec from Fort Coulonge on the west to Ste. Anne des Monts on the east.

In order to make the precise declination results available to the public in the most convenient form for ready reference, the custom prevailing in other countries of publishing declination maps has been followed. A new declination map, "Lines of Equal Magnetic Declination and Annual Change in Canada for 1927," was compiled from all data available to date from whatever sources, to form the latest map in the series published by this survey at five-year periods: 1907, 1912, 1917, 1922, 1927. Many small declination maps also were compiled for publication on the map sheets of the National Topographic series.

Through the courtesy of Mr. L. V. Rorke, Director of Surveys, Department of Lands and Forests of Ontario, a co-operative working arrangement was formulated whereby the Ontario Government surveyors will take declination observations on their work. Our own organization will, on its part, keep the compasses in proper working order and will undertake the necessary computations, the final results being available to both. The magnetic work of the Provincial Government will thus supplement the magnetic work of this survey in Ontario, the results being a more expeditious and economical survey, free from gaps.

The problem of the compass is further complicated by the fact that it changes its direction from year to year: it marches to the westward for many years, then turns back and marches to the eastward, then reverses again and marches to the westward, etc. Moreover, its very confusing behaviour is quite different at different places, the cause being as yet quite unknown.

Owing to this continual shifting or march of the compass, the work already accomplished would soon become obsolete if proper precautions were not applied to keep it up to date. Moreover, this march of the compass assumes particular importance in Eastern Canada and British Columbia. The old land surveys of Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island in the east and British Columbia in the west were made by compass; thus when it is required to resurvey and re-establish an old lost boundary line in any of these provinces, a knowledge of the march of the compass since the date the old survey was made is essential. This march may be quite large, four degrees at Charlottetown, Halifax, and St. John since 1840 for instance, five degrees at Quebec city and Toronto, six degrees at Montreal and Ottawa, and three degrees at Victoria.

For the purpose of supplying this information, declination repeat observations in close co-operation with the provinces were also taken during the year at important points.

A research was made on the results of all the repeat observations to date. These were carefully correlated and adjusted, and published as Bulletin No. 58, "The March of the Compass in Canada". This bulletin, which is prepared primarily for compass users, gives tables of the declination at 162 well-distributed stations for every tenth year generally from 1750 onwards to 1900, and thereafter for every fifth year to 1925. A research was also made on the average diurnal variation of declination, which must be taken into account in accurate compass surveying and tables embodying this information for 24 stations for the summer, winter, and equinoctial seasons were included in the bulletin.

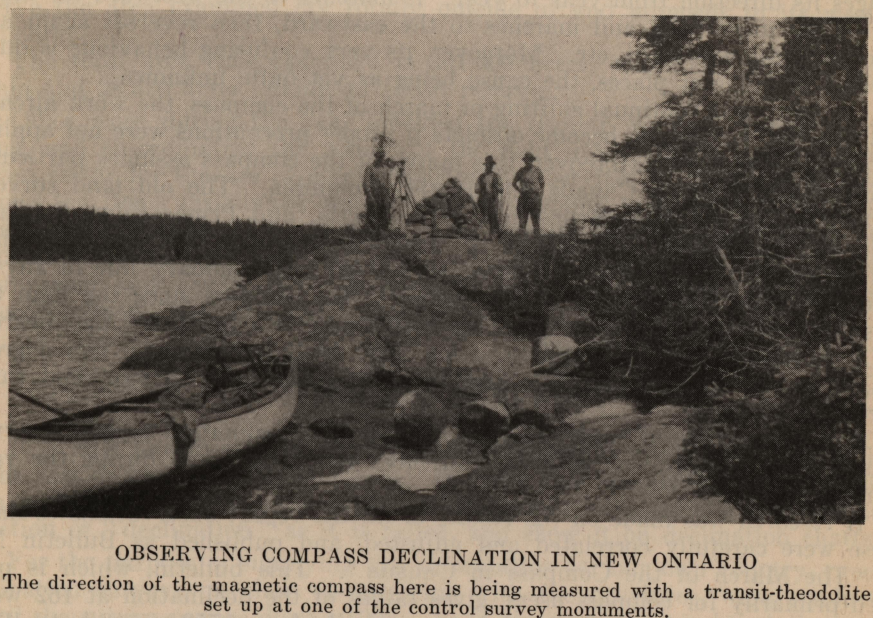
In co-operation with several of the provinces many meridian stations were established in conjunction with repeat stations and permanently marked for the convenience of provincial surveyors in standardizing the compasses of their theodolites.

For determining the intensity and the dip, which are very important in various researches regarding the behaviour of the compass, two Dover Dip Circles were employed, one in Nova Scotia and the other in Quebec. Observations were obtained at twenty-three stations.

The dip or inclination has acquired great practical importance since the recent invention of the Earth Inductor Compass, as this compass is governed not only by the declination but by the dip as well. Its advantage in airships and vessels is that it is not liable to "swing" or to be affected by local disturbances caused by nearby iron, etc., which affect the ordinary compass.

In order to make the dip readily available to the public in the most convenient and accessible form for ready reference for those interested in making researches of the compass behaviour and for those requiring it for use with the Earth Inductor Compass, the custom of other countries of publishing maps showing this information has been followed by this survey. A new dip map, "Lines of Equal Magnetic Dip and Annual Change in Canada for 1927," was compiled from all data available to date from all sources, and published, forming the latest in the series published by this survey at five-year periods: 1917, 1922, 1927.

As in the past, all instruments used on these surveys were standardized at the beginning and at the end of the season at the Magnetic Observatory, Agincourt, Ont., through the courtesy of Sir Frederic Stupart, Director of the Meteorological Service of Canada. Thus, all results are reduced to the International Magnetic Standard.



OBSERVING COMPASS DECLINATION IN NEW ONTARIO

The direction of the magnetic compass here is being measured with a transit-theodolite set up at one of the control survey monuments.

A special research was made in British Columbia, the results being contained in a paper, "Magnetic Surveying, with Recent Developments in British Columbia", contributed to the Pan-Pacific Science Congress, Tokyo, Japan; while several articles describing the work were written for publication.

Correspondence was carried on with many scientific and government authorities, commercial firms, and the general public; and declination maps distributed to those using the compass in their daily work. The stations were plotted on the map sheets of the National Topographic series and the Sectional Map series, and the other general office work of computing, reducing, and preparing returns for publication, determining index corrections for surveyors' transits, demonstrating methods of observing, issuing instructions for field work, compensating for diurnal inequality and secular variation, etc., were carried out as in the past.

PHYSICAL TESTING LABORATORY

The work on the laboratory standard rules having for its ultimate object the determination of the present length of the Canadian legal standard yard, and which was interrupted by a series of corrosion marks on one of them, was resumed and completed. The verification of the Dominion Standard Yard in terms of the Imperial Yard was then proceeded with. The Dominion Standard Yard occupies a fundamental position, comparable with that of the International Metre and the Imperial Yard, as it is defined by law to be the Dominion Standard for measures of length. A knowledge of the exact relation between the Dominion Standard and the Imperial Yard (and hence with other well-known standards of length) is therefore of great importance.

At the laboratory there has been for some time a need of facilities for conducting tests of various instruments at temperatures encountered in winter under practical conditions. It has been decided to install the necessary equipment to take care of this work. It is hoped to have a special testing refrigerator working next year.

General Instruments.—Press of other work prevented much progress with the experiments on the pointing of telescopes, although sufficient was done to indicate the way to a more systematic attack on the problem. It is hoped that more will be accomplished during the next summer, when there should be less routine work to occupy the attention of the technical staff.

An attempt was made to etch a small cross on an aerial camera at the trace of the line through the optical centre of the lens and perpendicular to the plane of the film. The operation was made possible by a glass plate, in contact with the film during exposure, being fitted to the magazine. It was decided to have the laboratory mark all magazines similarly. Such a cross indicates the principal point and saves the draughtsman's office time in the preparation of maps from aerial photographs.

At the request of the Department of National Defence, a design was prepared for a special optical instrument for certain research work.

Metrology.—Before commencing the actual test of the Standard Yard subsequently referred to as rule "A" at the Physical Testing Laboratory, some small improvements which previous experience had shown to be desirable were made to the one-metre comparator. The changes allowed the comparison of two rules to be made in about one-half the time that had been previously required. When the improvements had been effected some time was spent in making tests on the Laboratory Standard rules to remove so far as possible all known sources of error. What may appear to be minor considerations, such as methods of stirring the water, the position of the microscope field-illuminating lamps and even the switching on and off of the lights in the comparator room, affect the observations and have to be taken into consideration.

When all detected sources of error had been reduced to a minimum, the actual verification of "A" was carried out. A series was made up of the Dominion Standard Yard "A" and three of the Laboratory Standard rules, Nos. 191, 224, and 306. Of these, No. 191 is an invar rule, No. 224 a 42 per cent nickel-steel rule, and No. 306 a pure nickel rule.

In the verification of the Dominion Standard Yard the rules were compared one with another in pairs, choosing all possible pairs from the series. The most probable length of the bar "A" was computed from all the comparisons. Moreover, the rules were compared in pairs in all the eight possible positions they could occupy relatively to one another and to the observer.

During the test the rules were immersed in distilled water, the temperature of which was measured by four delicate thermometers which had been carefully standardized by the thermometer testing section of the laboratory.

The verification of "A" was carried out in this way three times, by three different observers working independently. This procedure was adopted as the defining lines on "A" are somewhat coarse (when compared with the more modern laboratory standards) and have an irregular appearance when viewed through the micrometer microscopes, which have a magnification of one-hundred diameters. It was considered that the mean of the interpretation of three independent observers would be a reasonable approximation to the true pointing made by those who originally standardized the bar.

The length found for "A" assumes that the Laboratory Standard rules 224 and 306 have not changed since they were verified in England in 1924. Arrangements are being made for the rules to be carried to the National Physical Laboratory by an official who is travelling to England, and as soon as the check verification is completed the length determined for the Dominion Standard Yard can be finally computed.

When the Dominion Standard Yard and its copies were verified by the Warden of the Standards in England in 1873, he stated in his report that the coefficient of thermal expansion should be investigated again. Accordingly during the fiscal year the coefficient of "A" was verified by direct observation.

A test was also made to determine the length of the old Canadian Standard Metre. This is a rule of similar form to the yard bars, but with the lines ruled at one metre apart. It was standardized in England in 1873 at the same time as the yard standards, by means of a standard, the length of which was known in terms of the Mètre des Archives.

While the International Metre has replaced the Mètre des Archives as the metric standard of length, it is of interest to know the present length of the legal prototype of the older standard. As in the case of the yard standard, the exact length of the Standard Metre cannot be stated with certainty until the Laboratory rules have been verified at the National Physical Laboratory.

Thermometry.—In connection with the verification of the Dominion Standard Yard the thermometry section conducted a number of tests on the 13 Tonnelot thermometers used in the metrological operations. The exact measurement of temperature is of fundamental importance in the study of metal standards of length. The Dominion Standard Yard "A", for instance, expands 17·6 parts in one million for a temperature rise of 1° C. An accuracy of one part in ten millions is aimed at in making a comparison between two standard rules, and hence the temperature of a rule with a thermal expansion of 17·6 parts in one million should be known accurately to at least 0·05° C., and as temperature is only one of several sources of error, 0·01° C. is aimed at in actual practice.

Measurement of temperature is analogous to that of length in that it is referred to a fundamental unit or scale, adopted by the International Conference of Weights and Measures. The unit is the indication of a thermometer which measures temperatures by the increase in pressure of a perfect gas. All thermometers used in precision work are referred directly or indirectly to the gas thermometer, just as length measures are referred to the standard yard or the standard metre.

Where an accuracy of 0.01 C° is needed the question of the standard scale becomes of importance. The Physical Testing Laboratory standards, with which the working thermometers were compared, have been carefully standardized by the National Physical Laboratory, in terms of the International Gas Scale, and their corrections are known to a few one-thousandths of a degree.

Barometers and Aeronautical instruments.—Besides a considerable amount of routine work on aneroid barometers, altimeters, air-speed indicators, gauges, etc., this section conducted some special tests on a number of new pattern instruments.

The most interesting of these was a surveying aneroid of unique design constructed by a well-known British firm of instrument makers in an endeavour to meet the specifications of the Physical Testing Laboratory. This aneroid had a number of interesting features, one being the absence of a main spring. It was direct reading and had a most remarkable freedom from secular change and was the first to meet all the laboratory tolerances. This test revealed a number of points where further improvements might be made with advantage and the manufacturers promised to consider these.

Subsequently this aneroid was submitted to the British Air Ministry, where it was given a special laboratory test, and it is at present being given a trial on shipboard, where its freedom from secular change would appear to be a valuable asset.

Other instruments of more orthodox design were received from a second well known British instrument manufacturing firm, who also are endeavouring to meet the laboratory specifications for surveying aneroids. In this case, too, the tests revealed some points where further improvement was desirable.

Two altimeters and an altigraph, all of the latest design, were also submitted by the last mentioned firm, and given exhaustive tests.

Until a short time ago altimeters were calibrated on the assumption that the atmosphere was at a temperature of 10° C. irrespective of the height. The errors involved were not considerable when only small heights were considered and, moreover, when accuracy was desired the temperature correction was readily and easily applied from the rule:—

"Correction=2 feet per 1000 feet elevation per one degree Fahrenheit."

At the heights now traversed by aeroplanes the temperature of 10° C. no longer even approximates to the mean temperature of the atmosphere, and altimeters calibrated to the old scale may be in error by over a thousand feet at heights of 20,000 feet or more.

Hence new tables are being adopted internationally for the relation between barometric pressure and height used in calibrating altimeters, in which each height is associated with a temperature, which is taken as the mean temperature of the column of air between the instrument and the ground. In these tables it is assumed that the ground temperature is 15° C., and that there is a steady drop in temperature within the heights which have to be considered. In calibrating or testing altimeters graduated to this new scale it is usual to associate the instrument with the temperature of the air in which it is used and in any case no instrument can be relied upon unless it is actually tested under working conditions.

The altimeters and altigraph mentioned could not be tested in accordance with standard practice, as the Physical Testing Laboratory had no means for exposing them to a temperature lower than 0° C. However, when the new refrigerator referred to on page 21 is installed tests to –40° C. can be made.

Two special precision altimeters made to specifications drawn up by the laboratory, and for use in experiments in determining the heights of aeroplanes engaged in photographing for surveying operations, were tested. One of these was unsatisfactory and was returned to the makers. Two surveying aneroids intended for the Dominion Observatory were also found to be unsatisfactory and rejected. All these instruments were by first class makers who had guaranteed to meet the test requirements. However, during the year some of the higher officials from the makers' works visited the Physical Testing Laboratory, and the requirements of aneroids for use on Canadian surveys were explained to them. It is hoped that as a result of this personal contact improved instruments will be forthcoming.

Instrument Shop.—The shop made some extensive repairs to a new type of theodolite for the Geodetic Survey. This type of theodolite is being used more and more, and as its construction and design are totally different from those of the more orthodox surveying instruments, the experience gained by the shop will be of great value for repairs to similar instruments in the future.

A magnifying stereoscope was built for examining vertical aero-photographs. This stereoscope is fitted with adjustable magnification. Another interesting instrument built by the shop was the optical research device for the National Defence Department, already mentioned.

MECHANICAL OPERATIONS

The Mechanical Division takes up the work connected with the preparation of the map sheets from the compilers, prepares the drawings, and puts them through the mechanical processes of photographing to zinc and lithographing. Other related work is done, such as the making of line cuts and half-tones, the developing and printing of photo-topographical survey negatives in the photographic office, and the making up of colour plates and stones in the lithographic office. Both offices contribute many aids to compiling and to drafting; the photographic office furnishes copies to any required scale and the lithographic office furnishes proofs of plates or stones in any combination. In each case the amount of hand work required is thereby greatly reduced. When the particular work arising from surveys is not too pressing, work is undertaken for other branches of the federal Government, for provincial governments, or for outside services.

The following is a summary of the work done:—

	No.	Total copies
(1) Jobs drafted, photographed to zinc, and lithographed	243	125,399
(2) Halftones and line cuts		126
(3) Miscellaneous jobs consisting largely of maps reduced to required scales for plotting or compiling or for furnishing aid to draftsmen		121

Relief Maps.—To date there have been twenty-six different models for relief maps completed, from which copies can be made by making casts, covering, and framing. These models include copies of various topographic map sheets of special interest issued by the survey, and also a copy of the map of Canada on the scale of 60 miles to one inch, with a vertical scale of 15,000 feet to one inch. The size of the latter model is 40 inches by 60 inches.

Six relief map models are under construction as follows:—

Map	Horizontal Scale	Vertical Scale	Size of Frame
Banff and Vicinity	1 mi. to 1″	4000′ to 1″	23 x 31″
Niagara River District	"	1000′ to 1″	28½ x 37½
Sussex	"	2000′ to 1″	25 x 25½″
Kamloops	"	4000′ to 1″	25 x 25½″
Lake Louise	"	4000′ to 1″	25 x 25½
Canada, small size	916 mi. to 1″	8000 to 1″	4″ diameter

REGISTRATION, RECORDS AND DISTRIBUTION

The work of the Registration, Records and Distribution Division consists, in general, of the registration and recording of all the various returns of surveys received from the surveyors in the field, and of the plans of rights of way, roads, mineral claims, Indian reserves, etc.; furnishing copies of field notes and traverse plots as required; dealing with technical correspondence relating to the surveyors' field notes; the storing and distributing of the official plans of townships, townsites, settlements, etc.; the distribution of the various maps and publications issued by the survey, and other related work.

The following survey returns were received for examination from surveyors in the field, railway companies, and provincial governments, and were entered in the various registers, plotted on the various index maps, etc.: 482 books of field notes; 524 plans; and 4,185 miscellaneous returns consisting of notes of magnetic surveys, progress sketches, various reports, etc.

On the completion of the examination, the field books and various original plans are placed on record. There is also recorded the signed copy of each official plan issued by the branch. During the year 659 new plans and 159 new books were placed on record. The total number on record is now 35,060 plans and 19,673 books of field notes.

The work of dealing with requests for technical information relating to surveys and survey records was carried on as usual. These requests are received from various branches of the federal and provincial governments, surveyors and engineers, law firms, and from the general public, and relate to survey monuments, disputed boundaries, etc. This involves not only the searching of the surveyors' field notes and files but in many cases the supplying of copies of the notes and the preparation of the usual survey sketches. When required for the law courts the copies of the notes and plans are officially certified to. Five hundred and twenty-nine such requests were dealt with.

The number of copies of the plans of townships, settlements, and townsites which were received and stored was 19,327. The number of copies distributed during the same period was 13,132.

The various maps, reports, technical pamphlets, etc., of the Survey were distributed throughout the year as usual. During the twelve months there were distributed 35,348 maps and 4,129 publications. Of this number 21,830 were paid for as compared with 13,721 last year. In the distribution of these 7,118 requests were dealt with.

The most important maps issued during the year were the map of the Red Lake district, the Pointe du Bois, Carroll Lake, and Lac Seul sheets of the National Topographic series on a scale of four miles to an inch, the Kamloops sheet of the above series on a scale of one mile to an inch, the maps of Calgary and Edmonton districts, the map of the Central Experimental Farm, the map of Northwestern Canada, the Aeronautical map of the Winnipeg district, the Calgary, Yorkton, and Sullivan Lake new series sectional maps, scale three miles to an inch, and sheets Nos. 118, 120, 163, and 164 of the new series sectional map, scale six miles to an inch. The most important publications were the one entitled " How to Read Topographic Maps " and the new edition of the catalogue of the various maps and publications issued by the Topographical Survey.

GEOGRAPHIC BOARD OF CANADA

The Department of the Interior is represented on the Geographic Board of Canada by four members, while the secretary is also an officer of the department. Mr. James White, Technical Adviser to the Minister of Justice, is the chairman of the Board, succeeding Colonel W. P. Anderson, representative of the Department of Marine and Fisheries since 1898, who died during the year.

Special features of the year's work were the steps taken to abolish duplication of names in Franklin district, Northwest Territories, and in Quebec, and the large number of rulings given on the names of features in northern Ontario plotted from aerial survey. A compilation giving the meaning of Alberta place names was prepared by the secretary from the records of the board and will be published.

BOARD OF EXAMINERS FOR DOMINION LAND SURVEYORS

The Board of Examiners for Dominion Land Surveyors held two meetings during the year.

The first was a special meeting lasting from Monday, May 3, 1926, to Friday, June 4, 1926 (inclusive), during which examinations were held at Ottawa, Winnipeg, Halifax, and Calgary.

The second was the regular annual meeting called for by section 9 of the Dominion Lands Surveys Act. It began on Monday, February 14, 1927, and lasted until Thursday, March 17, 1927 (inclusive). During this meeting, examinations were held at Ottawa, Winnipeg, Saskatoon, Vancouver and Sackville.

The total number of candidates who presented themselves at the examinations was fifty-three. Of these, thirty-two tried the preliminary examination, eight tried the final examination, and thirteen tried the levellers' examination.

Fourteen candidates were successful at the preliminary examination, as follows:—

Bostock, Wm. Norman, Vancouver, B.C.
Bunting, Wm. Lloyd, Winnipeg, Man.
Kilpatrick, Wm. Galway, Winnipeg Man.
Wadge, Roy, Winnipeg, Man.
MacDonald, Wm. A., Sackville, N.B.
Robinson, Richard Henry, Winnipeg, Man.
Bereskin, Abram Isaac, Winnipeg, Man.
Scull, Boucher Pratt, Saskatoon, Sask.
Jenkins, Wm. Stockton, Ottawa, Ont.
MacLeod, Donald Angus, Sackville, N.B.
Gaver, Edward, Winnipeg, Man.
Sexton, Jack Kenneth, Saskatoon, Sask.
Phillips, Edward Kent, Saskatoon, Sask.
Carefoot, Herbert Reginald, Saskatoon, Sask.

Four candidates were successful at the final examination, as follows:—

Cole, Arthur Wm. Willoughby, Ottawa, Ont.
Humphreys, William, Winnipeg, Man.
Surette, Germain Augustin, Halifax, N.S.
Jones, Gordon Rosebrugh, Ottawa, Ont.

Eight candidates were successful at the levellers' examination, as follows:—

Gorman, Oswald John, Ottawa, Ont.
Costell, Allan, Winnipeg, Man.
Peebles, Archibald, Vancouver, B.C.
Fraser, Reginald Alfred Stephen, Sackville, N.B.
Dore, Jackson Ira, Ottawa, Ont.
Pretious, Edgar Sinclair, Vancouver, B.C.
Duckering, Chas. Elmhirst, Vancouver, B.C.
Lord, Clifford Symington, Vancouver, B.C.

The time of the board during the meetings, apart from the consideration of the amendments to the curriculum, was largely taken up with the reading and valuation of the candidates' answer papers. Complete sets of question papers to be used at the following examinations were also prepared. In addition to this, the evidence submitted by candidates at the final examination in proof of their eligibility therefor had to be examined. This evidence consisted of certificates of Provincial Land Surveyors and of affidavits of service under Articles of Apprenticeship. The finished plans and notes as well as the plans and notes executed under field conditions, furnished by candidates at the final examination had also to be examined and evaluated.

Four commissions were issued to candidates who had passed the final examination and had furnished oaths of office and allegiance and bonds for the sum of $1,000, as required by section 25 of the Dominion Lands Surveys Act.

Eight certificates of preliminary examinations were issued to successful candidates who had complied with the requirements of the law, and three certificates as levellers were issued to candidates who had successfully passed the examination.

One standard measure of length was issued during the year.

APPENDIX

SCHEDULE OF SURVEYORS EMPLOYED AND WORK EXECUTED BY THEM

Bennett, G. A.

In co-operation with A. L. Cumming, the completion of the topographical survey (plane-table) of the Wolfville sheet, No. 21 H/1, which sheet is included within north latitudes 45° 00′ and 45° 15′ and longitudes 64° 00′ and 64° 30′, west of Greenwich, and the Blomidon peninsula to Cape Split.

Blanchet, G. H.

Investigations of the area comprising Wood Buffalo park and of the country between lake Athabaska and Great Slave lake.

Bridgland, M. P.

The topographical survey (plane-table) of the Calgary Northeast sheet, No. 82 P/4, and parts of the Calgary Southeast sheet, No. 82 I/13, and the Calgary Southwest sheet, No. 82 J/16, of the National Topographic series, the Calgary Northeast sheet being included within north latitudes 51° 00′ and 51° 15′ and longitudes 113° 30′ and 114° 00′, west of Greenwich, the Calgary Southeast sheet within north latitudes 50° 45′ and 51° 00′ and longitudes 113° 30′ and 114° 00′, west of Greenwich, and the Calgary Southwest sheet within north latitudes 50° 45′ and 51° 00′ and longitudes 114° 00′ and 114° 30′, west of Greenwich; the continuation of the photo-topographical survey of the north half of sheet No. 82 L/NE, of the National Topographic series, lying within north latitudes 50° 30′ and 51° 00′ and longitudes 118° 00′ and 119° 00′, west of Greenwich.

Calder, J. A.

Suburban lot subdivision in township 2, W.C.M., township 13, E.C.M., and township 16, E.C.M.; surveys for Department of Indian Affairs near Lytton; two small lot surveys on Harrison lake, one on Pitt lake, and a villa lot subdivision on Shuswap lake near Sicamous; two timber berth surveys in township 4-2-7.

Cameron, M. G.

Astronomical observations and miscellaneous surveys in northwestern Ontario in order to interpret and provide control for aerial photographs.

Carroll, J.

Vertical aerial photographic surveys covering Rouyn-Larder Lake and Rouyn Lake sheets, and portions of three other sheets of the National Topographic series, on the two-mile scale, in the Rouyn area, provinces of Ontario and Quebec.

Cautley, R. W.

Location of Kootenay National Park boundary and the monumenting of straight line courses thereon where such were necessary.

Christie, Wm.

Combined land classification and revision survey within townships 61 to 64, from range 15 westerly to Fifth meridian; subdivision of a portion of Saddle Lake Indian reserve in townships 57 and 58, ranges 10 and 11, west of the Fourth meridian.

Cowper, G. C.

Topographical mapping for the first field revision of the Battleford sheet, No. 267, of the Sectional Map series, comprising townships 41 to 48, ranges 15 to 28, inclusive, west of the Third meridian; renewal of monuments.

Cumming, A. L.

In co-operation with G. A. Bennett, the completion of the topographical survey (plane-table) of the Wolfville sheet, No. 21 H/1, of the National Topographic series, which sheet is included within north latitudes 45° 00′ and 45° 15′ and longitudes 64° 00′ and 64° 30′, west of Greenwich, and the Blomidon peninsula to Cape Split; observations for magnetic declination, dip, and total force and the establishment of magnetic meridian stations at different points in the province of Nova Scotia.

Davidson, R. D.

Oblique aerial photographic surveys covering Trout Lake, Lake St. Joseph, Sioux Lookout, and Armstrong sheets, in Western Ontario, and The Pas, Grand Rapids, Cormorant Lake, and Wekusko Lake sheets, and portions of five other sheets in Manitoba, all of the National Topographic series on the four-mile scale.

Oblique aerial photographic resurveys covering portions of Selkirk and Pointe du Bois sheets, of the National Topographic series on the four-mile scale, in Manitoba.

Oblique aerial photography of the various falls on the English river in Ontario, from Lac Seul to the Manitoba-Ontario boundary.

Dickson, H. G.
Eight miles of reference traverse from Crystal Lake to Galena Hill, and twenty miles of reference traverse fom Rambler Hill to Beaver River, Yukon Territory.
(Performed under contract, Mr. Dickson not being a member of the permanent staff).

Donnelly, C. B. C.
Oblique aerial photographic surveys covering Trout Lake, Lake St. Joseph, Sioux Lookout, and Armstrong sheets, in Western Ontario, and The Pas, Grand Rapids, Cormorant Lake, and Wekusko Lake sheets, and portions of five other sheets in Manitoba all of the National Topographic series on the four-mile scale.
Oblique aerial photographic resurveys covering portions of Selkirk and Pointe du Bois sheets, of the National Topographic series on the four-mile scale, in Manitoba.
Oblique aerial photography of the various falls on the English river in Ontario, from Lac Seul to the Manitoba-Ontario boundary.

Fawcett, S. D.
Astronomical observations and miscellaneous surveys in northwestern Ontario in order to interpret and provide control for aerial photographs.

Fletcher, W. A.
Topographical mapping for the first field revision of the Selkirk sheet, No. 62 I, of the National Topographic series, which sheet is included within north latitudes 50° 00′ and 51° 00′ and longitudes 96° 00′ and 98° 00′, west of Greenwich; renewal of monuments.

Fry, E. S.
Oblique aerial photographic surveys covering Trout Lake, Lake St. Joseph, Sioux Lookout, and Armstrong sheets, in Western Ontario, and The Pas, Grand Rapids, Cormorant Lake, and Wekusko Lake sheets, and portions of five other sheets in Manitoba, all of the National Topographic series on the four-mile scale.
Oblique aerial photographic resurveys covering portions of Selkirk and Pointe du Bois sheets, of the National Topographic series on the four-mile scale, in Manitoba.
Oblique aerial photography of the various falls on the English river in Ontario, from Lac Seul to the Manitoba-Ontario boundary.

Hawkins, A. H.
Topographical mapping for the second field revision of the Winnipeg sheet, No. 62 H, of the National Topographic series, which sheet is included within north latitudes 49° 00′ and 50° 00′, and longitudes 96° 00′ and 98° 00′, west of Greenwich.

Knight, R. H.
Duck Bay settlement in township 37-19-Pr.; addition to Badger townsite in township 3-12-E.; addition to Rackham townsite in township 18-19-Pr.; addition to Mafeking townsite in township 43-26-Pr.; addition to Rosetown townsite in township 30-15-3; subdivision of a portion of township 37-29-Pr.; survey of historic site at Fort Pelly in township 34-32-Pr.; miscellaneous surveys in township 17-11-E.; township 31-17-Pr.; township 10-15-Pr., and township 22-22-2.

LeBlanc, P. M. H.
Control surveys for topographic mapping of the Grondines sheet, No. 31 I/9, of the National Topographic series, which sheet is included within latitudes 46° 30′ and 46° 45′, and longitudes 72° 00′ and 72° 30′, west of Greenwich.

Lonergan, G. J.
Examination and classification of lands within and adjoining forest reserves as follows:
1. Big River forest reserve—part of townships 52, ranges 10, 12 and 13; township 53, range 10; part of townships 53, ranges 7 to 9 and 11 to 13; townships 54, ranges 10 and 11; part of townships 54, ranges 7, 8, and 12; township 55, range 8; part of townships 55, ranges 7 and 12, all west of the Third meridian.
2. Pines and Nisbet forest reserves—the north half of section 15, township 47-1-3, and the northwest quarter of section 35, township 49-1-3.
3. Seward forest reserve—all the lands within the different blocks of this reserve, together with additional lands outside and adjacent to certain of these blocks, the area thus covered being located within township 14 and 15, ranges 15, 16, and 17, and township 14, range 18, all west of the Third meridian.
4. Fort à la Corne forest reserve—a block of land located near the northeast corner and partly within and partly without the reserve, and comprised within part of townships 50 and 51, ranges 15 and 16, west of the Second meridian.
5. Three Rivers forest reserve—an area proposed to be added to the aforementioned forest reserve and comprising part of townships 51 and 52, ranges 13 and 14, west of the Second meridian.

Macdonald, C. S.

Control traverse surveys in northern Saskatchewan extending from Montreal lake through lac la Ronge to Churchill river; easterly through Wabawekka lake to Deschambault river and Oskikibuk lake; and along Churchill river from Sandfly lake to Frog Portage.

McCusker, K. F.

Astronomical observations and miscellaneous surveys in northwestern Ontario in order to interpret and provide control for aerial photographs.

Palmer, P. E.

The collection of topographical information for the publication of sheet N.M.-13 of the International Map of the World series, which sheet lies within north latitudes 48° 00′ and 52° 00′ and longitudes 102° 00′ and 108° 00′, west of Greenwich; experimental work with reference to the use of aerial photographs in topographical mapping.

Pierce, J. W.

Control traverse surveys in northwestern Ontario extending from Trout-lake river via Woman lake, Birch lake and Cat lake to lake St. Joseph, also from lake St. Joseph via Wabakimi and Savant lakes to Bucke railway station on the Canadian National Railways.

Rinfret, C.

The completion of the topographical survey (plane-table) of the Shawinigan sheet, No. 31 I/10, of the National Topographic series, which sheet is included within north latitudes 46° 30′ and 46° 45′ and longitudes 72° 30′ and 73° 00′, west of Greenwich; observations for magnetic declination, dip, and total force and the establishment of magnetic meridian stations at different points in the province of Quebec.

Taggart, C. H.

Control surveys and topographical mapping on the Kamloops Lake sheet, No. 92 I/NE., of the National Topographic series, which sheet lies within north latitudes 50° 30′ and 51° 00′ and longitudes 120° 00′ and 121° 00′, west of Greenwich; survey of lots at Sicamous Junction.

Waugh, B. W.

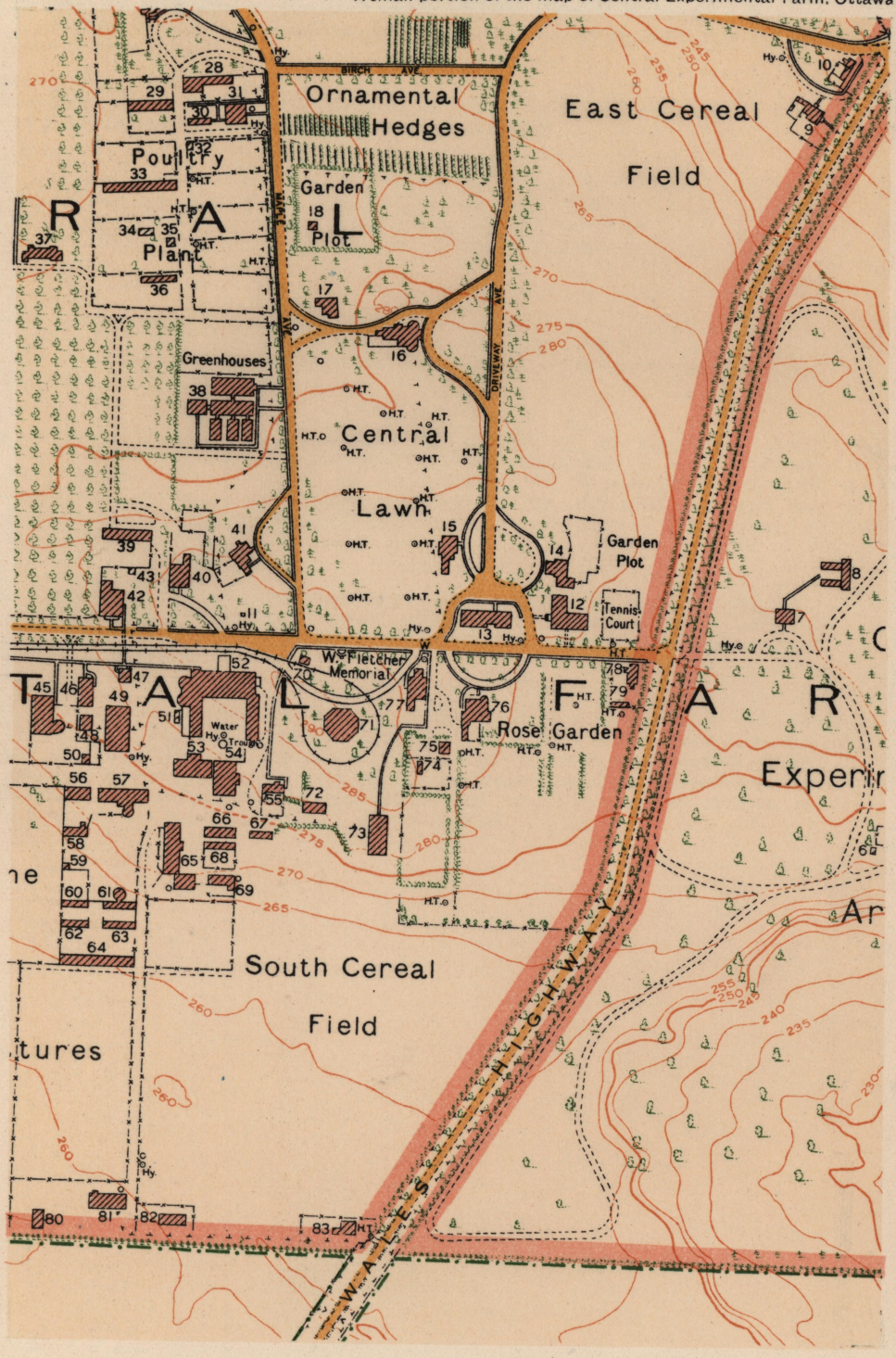
Control surveys for topographical mapping of the Fredericton sheet, No. 21 G/15, of the National Topographic series, which sheet is included within north latitudes 45° 45′ and 46° 00′ and longitudes 66° 30′ and 67° 00′, west of Greenwich; topographical survey (plane-table) of a part of the Fredericton sheet; observations for magnetic declination and the establishment of magnetic meridian stations at different points in the province of New Brunswick.

This vertical aerial photograph was used in the compilation of the portion of the map sheet of the Central Experimental Farm and vicinity shown opposite. It is one of a series of mapping views taken for this purpose.

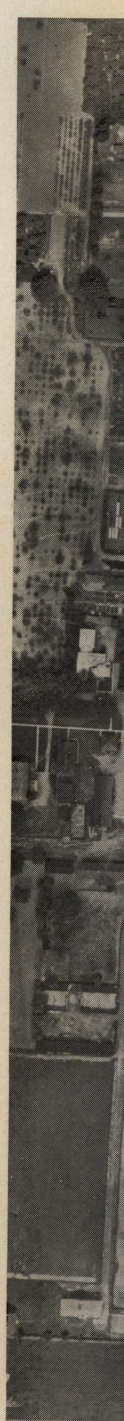
DEPARTMENT OF THE INTERIOR

TOPOGRAPHICAL SURVEY

A small portion of the map of Central Experimental Farm, Ottawa



Scale 400 feet to 1 inch



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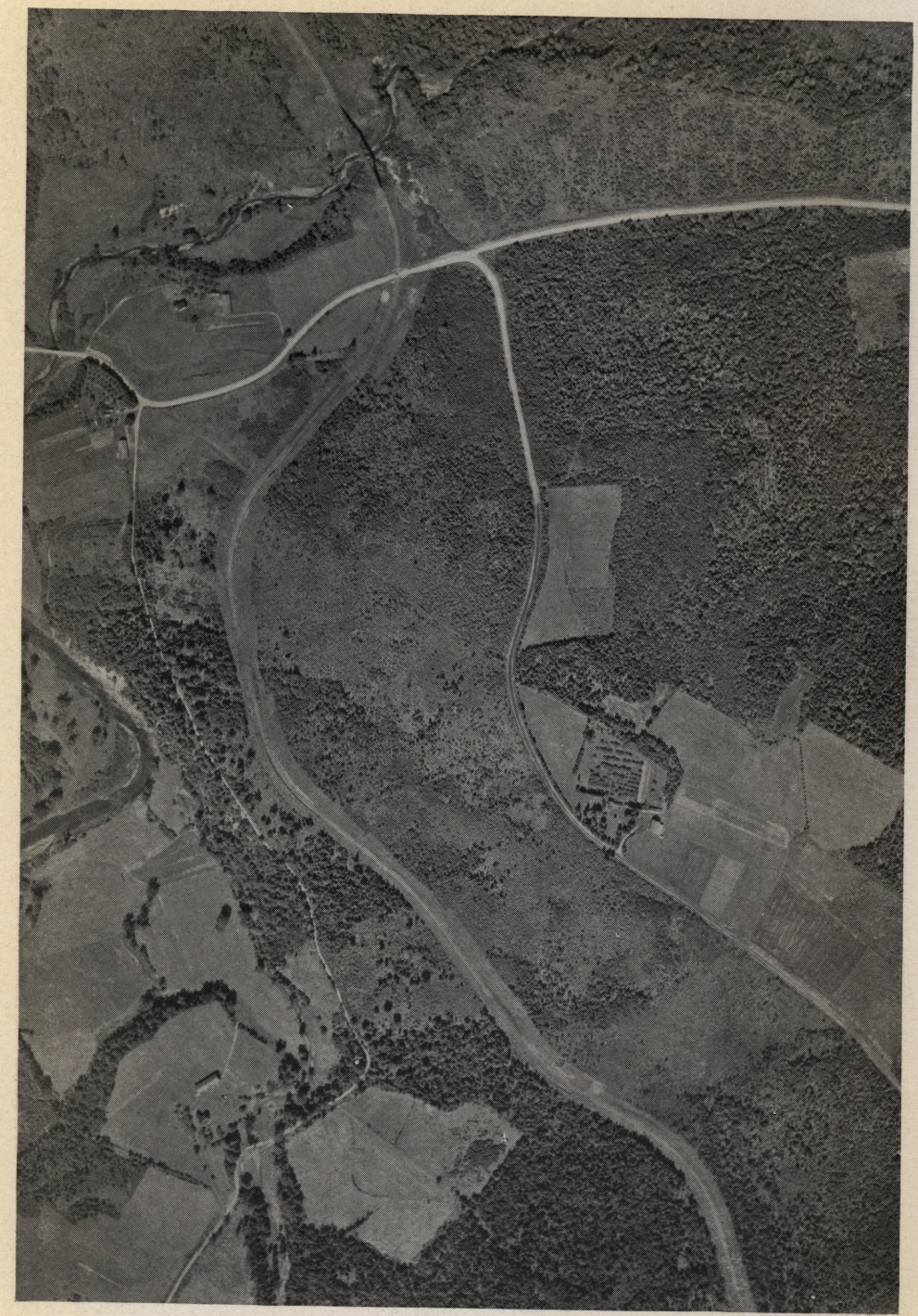
This vertical aerial photograph was used in the compilation of the portion of the map sheet of the Central Experimental Farm and vicinity shown opposite. It is one of a series of mapping views taken for this purpose.



Vertical aerial photographs were used in the preparation of the New Glasgow sheet of the National Topographic series, a portion of which is shown opposite. One of these photographs is reproduced above; it covers that part of the map outlined in pink immediately northwest from Westville.

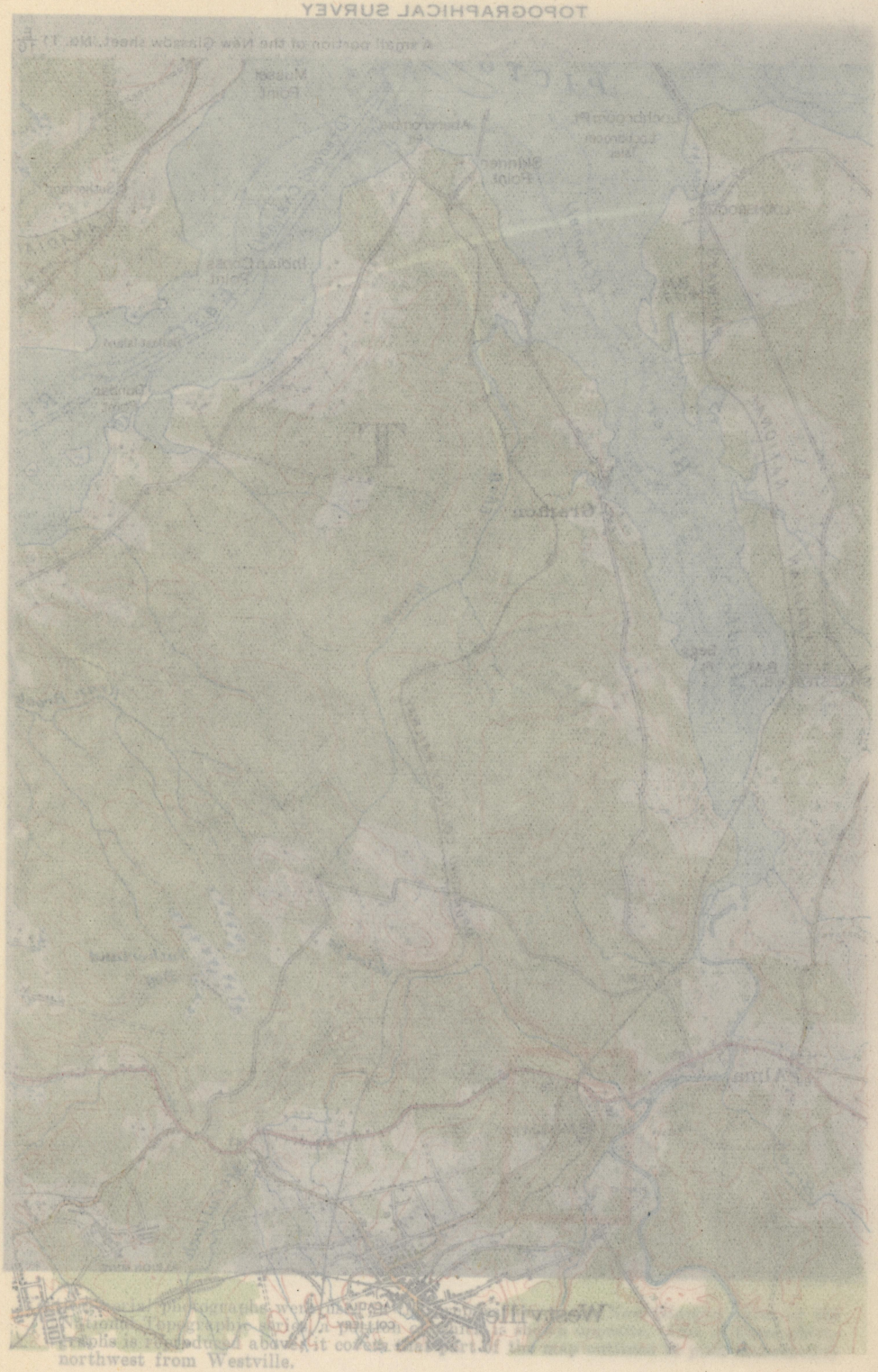
DEPARTMENT OF THE INTERIOR

TOPOGRAPHICAL SURVEY

A small portion of the New Glasgow sheet. No. 11 E/10

NATIONAL TOPOGRAPHIC SERIES

Scale 1 mile to 1 inch

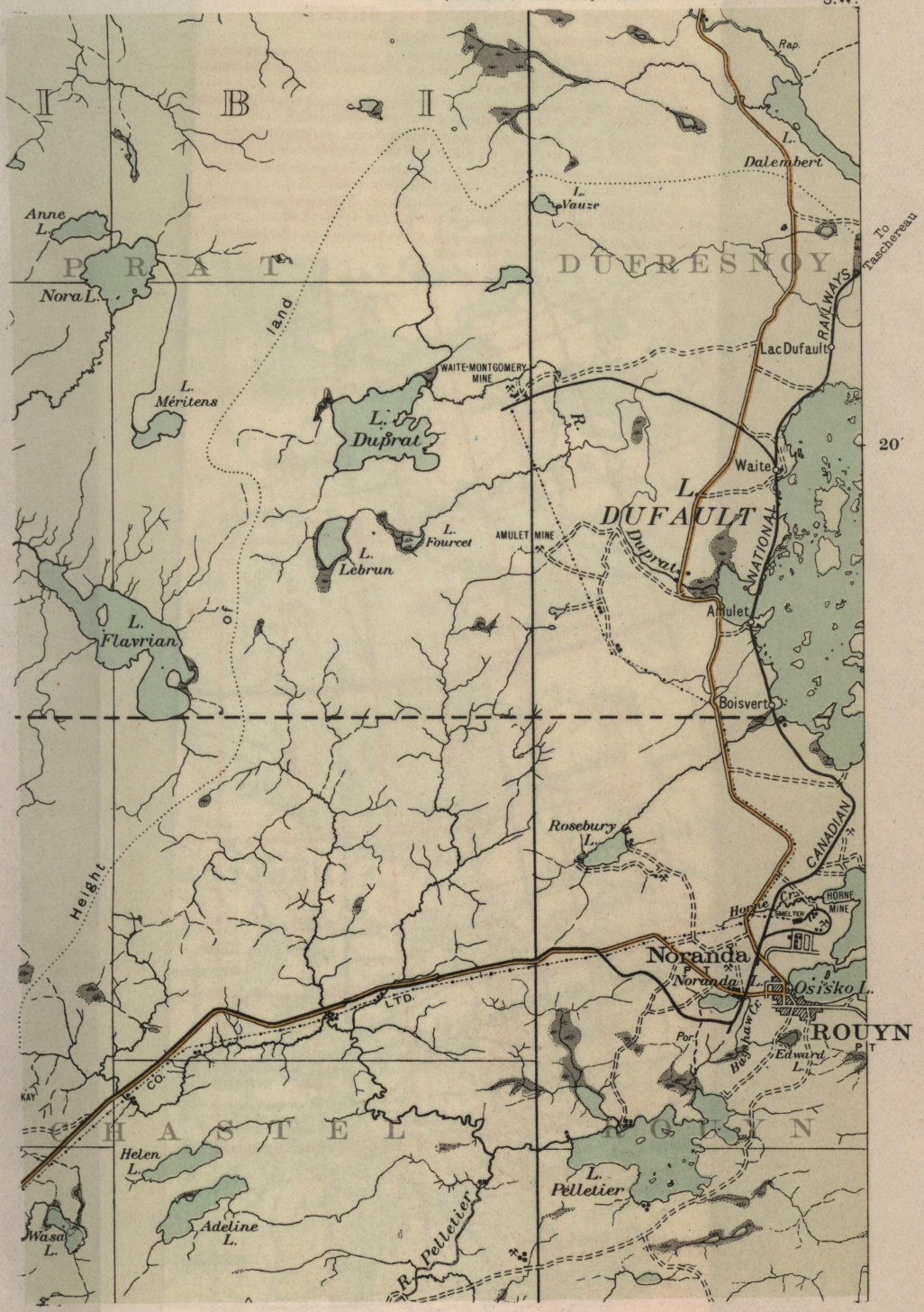

northwest from Westville.

Anne L.
Nora L.
Height
Wasa L.

DEPARTMENT OF THE INTERIOR

TOPOGRAPHICAL SURVEY

A small portion of the Rouyn-Larder Lake sheet, No 32 $\frac{D}{S.W.}$



NATIONAL TOPOGRAPHIC SERIES

Scale 2 miles to 1 inch

DEPARTMENT OF THE INTERIOR

TOPOGRAPHICAL SURVEY

A small portion of the Rouyn-Lardier Lake sheet, No 32 S.W.

NATIONAL TOPOGRAPHIC SERIES

Scale 2 miles to 1 inch

SYSTEM OF NUMBERING SHEETS

(See diagram at upper right hand corner)

The basis of the index is a unit, integral parts of which comprise a complete map sheet of the Carte du Monde au Millionieme. The unit consists of sheets 4° in latitude by 8° in longitude on the scale of sixteen miles to one inch whose numbers are shown on the index thus..... 53

EIGHT-MILE SHEETS: Each sixteen mile sheet is quartered into sheets of scale eight miles to one inch named respectively, N.W., N.E., S.W., S.E.; the number taking the form thus ..... 53 N.W.

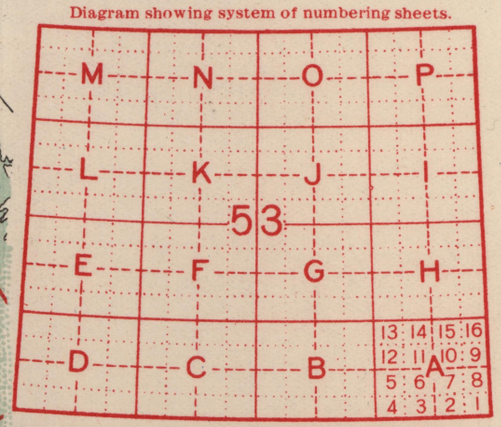
FOUR-MILE SHEETS: Each sixteen mile sheet is divided into sixteen sheets of scale of four miles to one inch lettered regularly from A to P as shown on the diagram, the number taking the form thus..... 53 G

TWO-MILE SHEETS: Each four mile sheet is quartered into sheets of scale two miles to one inch named respectively, N.W., N.E., S.W., S.E.; the number taking the form thus..... 53 A/N.W.

ONE-MILE SHEETS: Each four mile sheet is divided into sixteen sheets of scale one mile to one inch numbered from 1 to 16 as shown on the index, the number taking the form thus..... 53 A/7

Every sheet will also be given a name indicating its location by reference to the largest city or town in it, or by reference to some well known geographical feature.

Diagram showing system of numbering sheets.



Every numbered unit in the main index is subdivided the same as the above, which, for clearness is shown on a scale larger than the map below.

INDEX TO MAP SHEETS OF THE NATIONAL TOPOGRAPHIC SERIES

ISSUED BY THE

TOPOGRAPHICAL SURVEY, DEPARTMENT OF THE INTERIOR, OTTAWA

NOTE: This skeleton index map is intended only to furnish a general idea regarding the system of numbering the map sheets of the National Topographic Series. Index maps on a larger scale with more complete information are available upon application.

BASE MAP FROM CHIEF GEOGRAPHER'S MAP OF THE DOMINION OF CANADA

PRINTED BY THE TOPOGRAPHICAL SURVEY OF CANADA, OTTAWA